



JHelioviewer

Taming the Avalanche of SDO Data



D.A.N. Müller¹, M. Langenberg², S. Pagel³, L. Schmidt⁴, J. P. García Ortiz⁵, G. Dimitoglou⁶, V. K. Hughitt⁷, J. Ireland⁷, B. Fleck¹

¹European Space Agency, NASA GSFC, USA, ²RWTH Aachen, Germany, ³University of Applied Sciences (HTW) Berlin, Germany, ⁴University of Cambridge, UK, ⁵University of Almería, Spain, ⁶Hood College, USA, ⁷ADNET Systems Inc., NASA GSFC, USA

Abstract

JHelioviewer is a solar image browser geared towards large and complex data sets from SOHO and SDO. It is based on the JPEG 2000 compression standard for highly efficient browsing in space and time. Movies are generated and can be manipulated in real time. Our implementation¹ is both flexible, scalable and platform-independent. The random code stream access of the interactive JPIP protocol minimizes data transfer and encapsulates meta data. This approach offers a solution to the problem of distributing the vast amount of SDO data to the world-wide community.

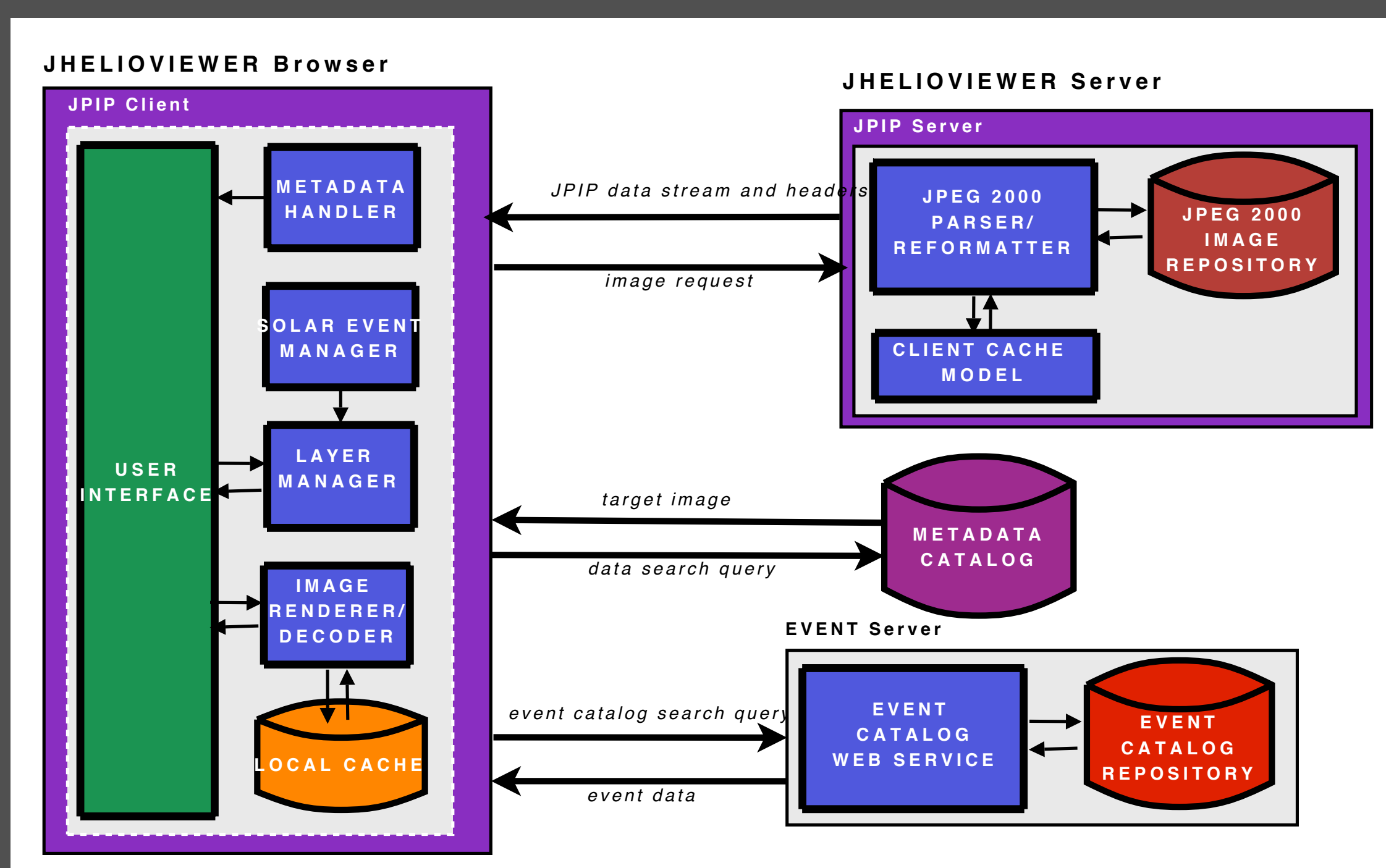
What is JHelioviewer?

- JHelioviewer is an open-source application², implemented in Java and OpenGL
- Uses the most efficient implementation of the JPEG 2000 standard⁴ (Kakadu SDK)
- Can be launched as a stand-alone application or from any web browser using Java Web Start
- Runs on Linux, Mac OS X and Windows

What can JHelioviewer do?

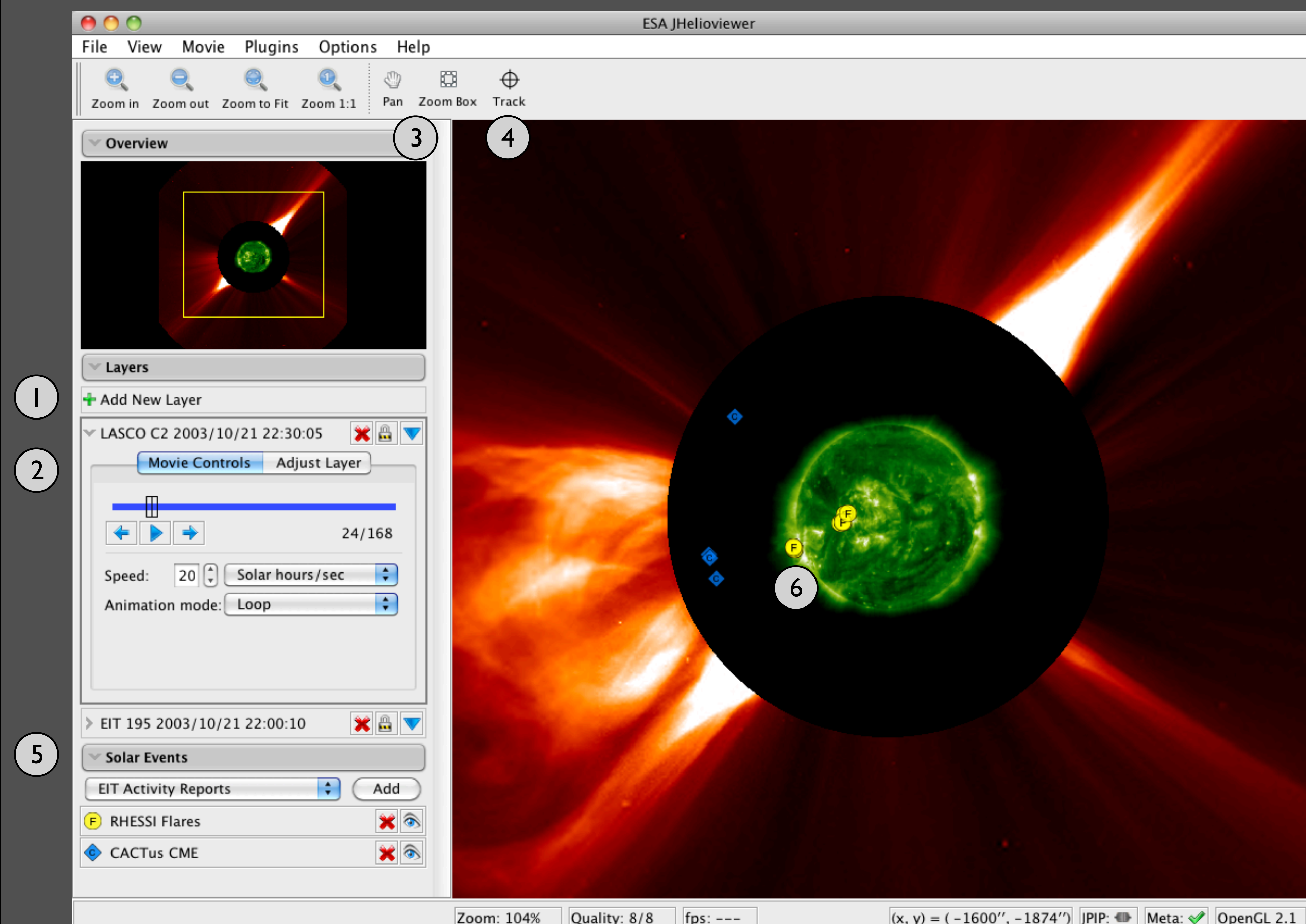
- Interactively stream and generate movies:
 - Overlay and nest images and movies
 - Zoom and pan while playing
 - Real-time image processing, e.g. sharpening and gamma correction
- Query event catalogs
- Display metadata, e.g. solar events
- Access all SOHO images, local files in various formats and data from any JPIP server

JHelioviewer Architecture



The JHelioviewer architecture with its basic parts and components: the browser (client), server and the solar event server.

Quick Tour



Download at
jheliviewer.org

- 1 Pick data in Layer Manager
- 2 Layer Controls: Play movies, adjusts filters and overlays
- 3 Zoom and pan movies while playing
- 4 Track solar rotation
- 5 Query event catalogs
- 6 Overlay solar event markers

Making SDO Data Browsable for Everyone, Everywhere



SDO's AIA instrument takes 16MP images in 10 channels, every 10 sec, 24/7 → >1 Petabyte of science data/year!

Challenges:

- Data access and distribution
- Search
- Visualization

Solution:

- With JPEG 2000: Can compress 4k × 4k image to 1 MB at good visual quality for browsing
- Store all 10 channels at 30 sec cadence → 29 GB/day = 10.6 TB/year
- Can keep comprehensive set of browse data online for entire mission (science data: only few months)

Why JPEG 2000?

JPEG 2000 is a wavelet-based image compression standard that supports both lossless and lossy compression and offers multiple advantages over other compression schemes:

- Browsing remote image archives via the JPIP protocol: Efficient movie streaming through random code stream access
- Multiple resolution representation: Images at different resolutions are automatically created during the compression process
- Quality layers: Optimize bandwidth usage by streaming remote data at variable quality
- Flexible file format to include rich metadata
- Superior compression performance
- Read/write routines built into IDL

References

- ¹<http://www.jheliviewer.org/paper.pdf>
- ²<https://launchpad.net/jheliviewer>
- ³<http://www.kakadusoftware.com>
- ⁴<http://www.jpeg.org/jpeg2000/>

Contact: Daniel Müller
dmueller@esa.nascom.nasa.gov

